

Exploring Climate change impact on water resources In Middle Draa Valley, Morocco

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Introduction

In this presentation, we investigate the water supply-demand relationship under climate change (CC) and socio-economic scenarios in the southeastern area of Morocco. We also identified some of the climate-hydrological variables of water vulnerability at the watershed scale. For this end, the outputs of some general circulation models run under different scenarios socio-economical and CC (A2 and B2) were used. To proceed with these data, Statistical downscaling models (SDSM) were used to simulate the CC parameters at the local scale, and the Water Evaluation and Planning System (WEAP) to simulate water systems. The findings show that under the scenario of CC, A2, the region experience more severe droughts than under B2 scenarios. The estimation of the water balance depicts that the area will record a lack of supply.

Methodology

This current study was carried out in Middle Draa Valley (MDV), Southeastern area of Morocco.

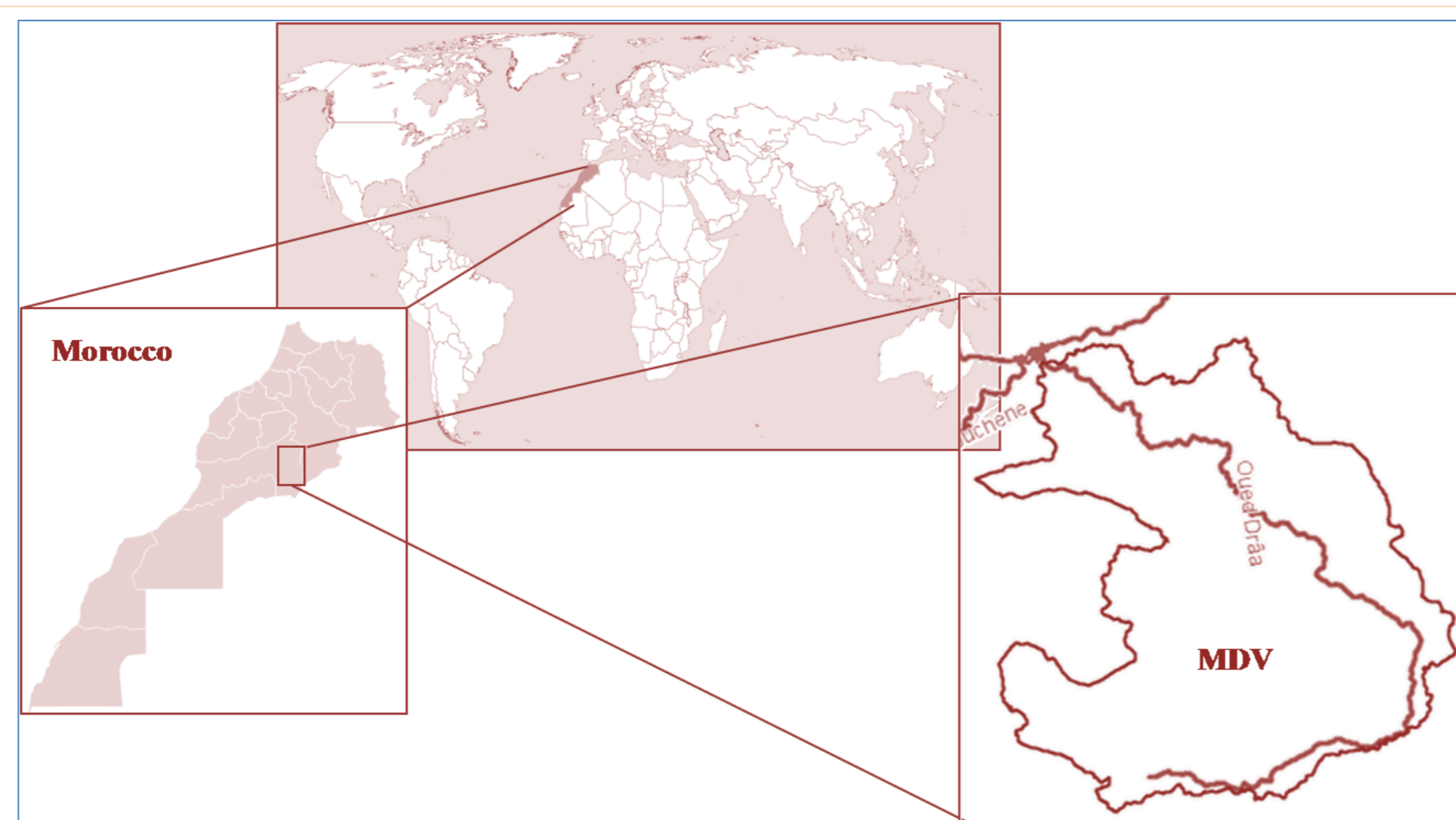


Figure 1. Localization of the study area: Middle Draa Valley

1. To assess the local climate change impacts a robust statistical downscaling technique (SDSM Model) was used.
2. To explore the offer/demand of water, Water Evaluation and planning System was used.

The study area including the approximate location of the demand sites of the Middle Draa Valley simulated using WEAP (Figure 2).

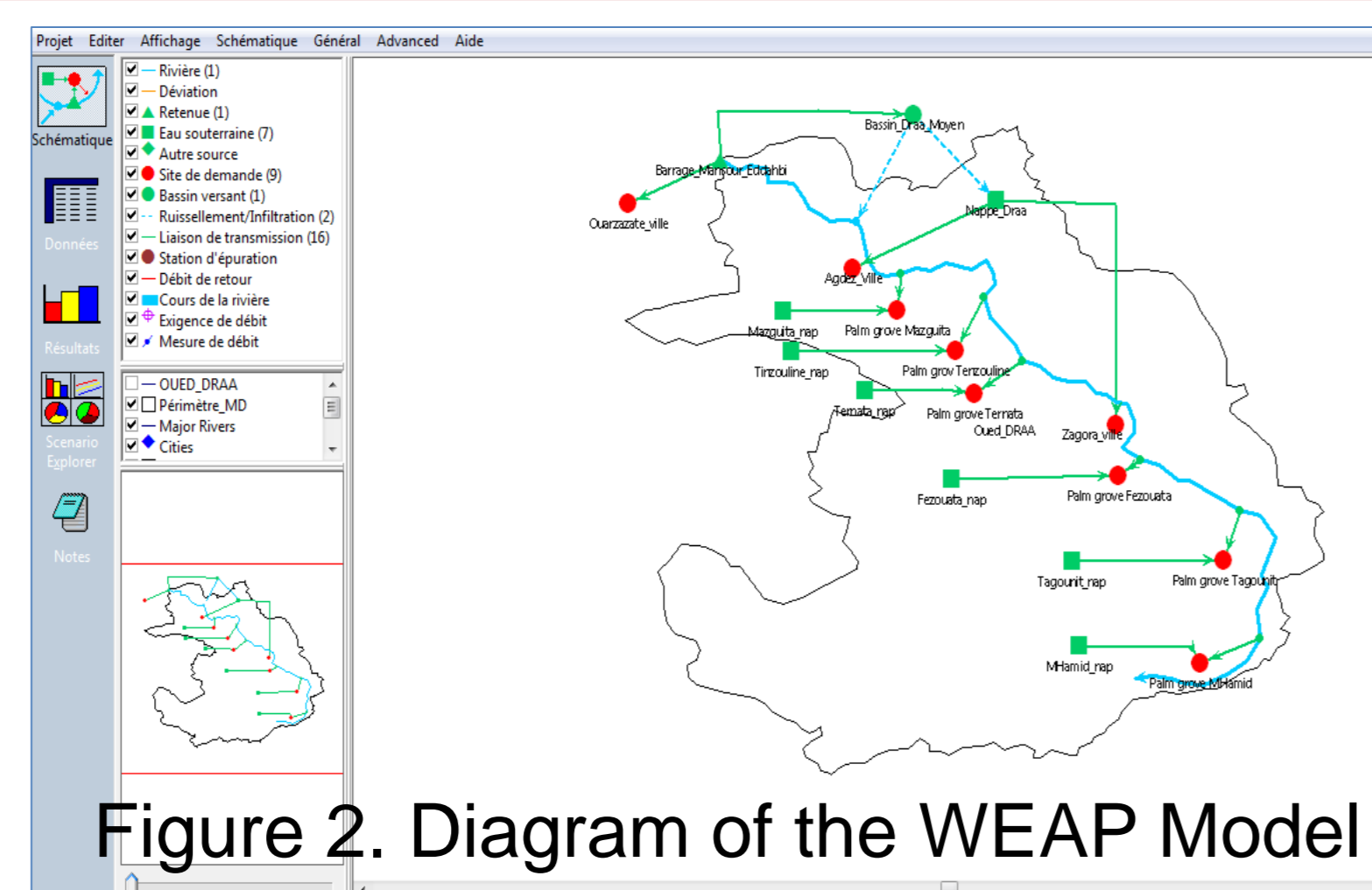


Figure 2. Diagram of the WEAP Model

Table 1. Overview of A2 and B2 scenarios parameters (Cited by [25])

| Storylines | A2 scenario | B2 scenario |
|---|--|------------------------------------|
| Regionalization (heterogeneous world) | Regionally oriented economic development | local environmental sustainability |
| Population growth | high | medium |
| GDP growth | high | medium |
| Energy use | high | medium |
| Land-use changes | medium/high | medium |
| Resource availability | low | medium |
| Pace and direction of technological Change favoring | slow regional | medium "dynamics as usual" |

Results (1)

The calculation of future climate anomalies during (1961–2099) for precipitation shows that under climate change scenarios (A2 & B2), the SDSM model predict a decrease in annual precipitation.

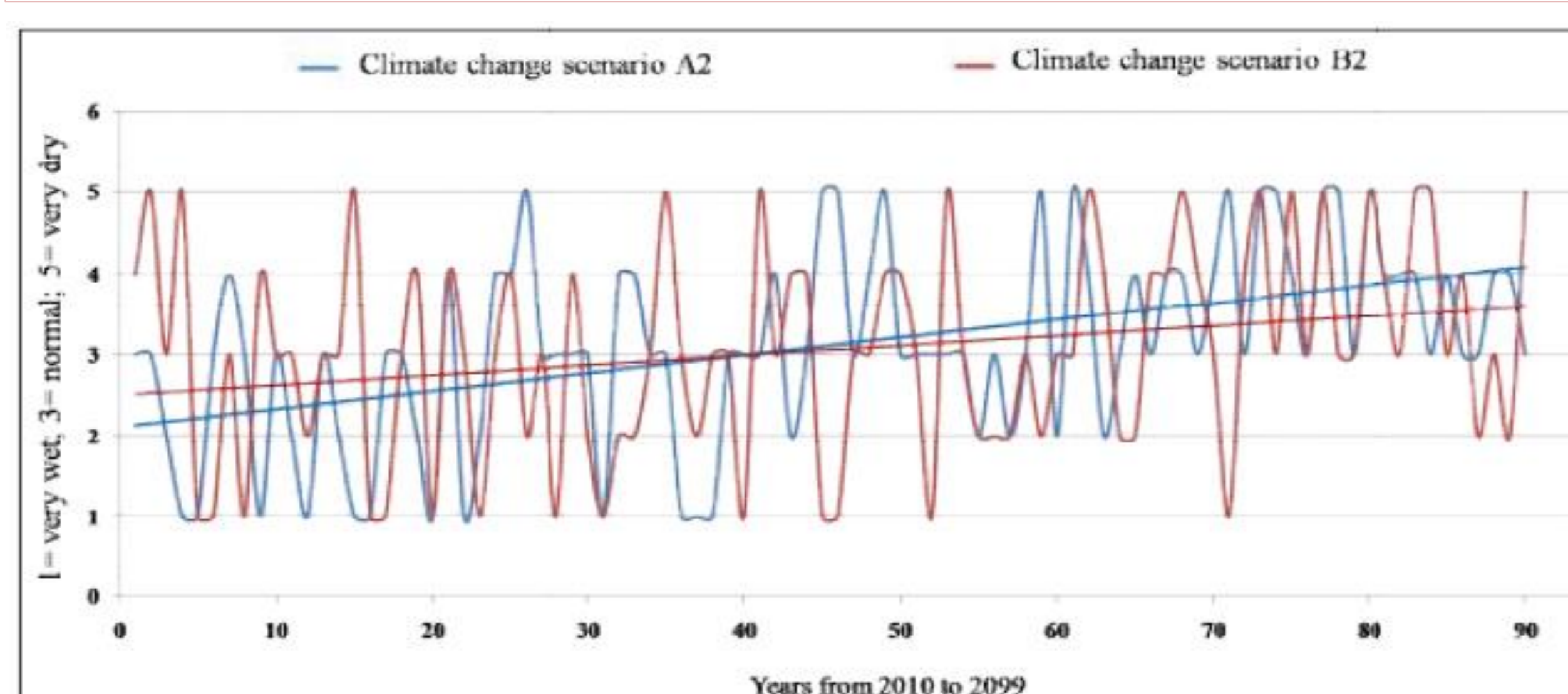


Figure 3. Sequence of wet and dry years for A2 and B2 scenarios (2010 -2099). Water year type: 1 = very Wet, 2 = Wet, 3 = Normal, 4 = Dry, 5 = Very Dry

Results (2)

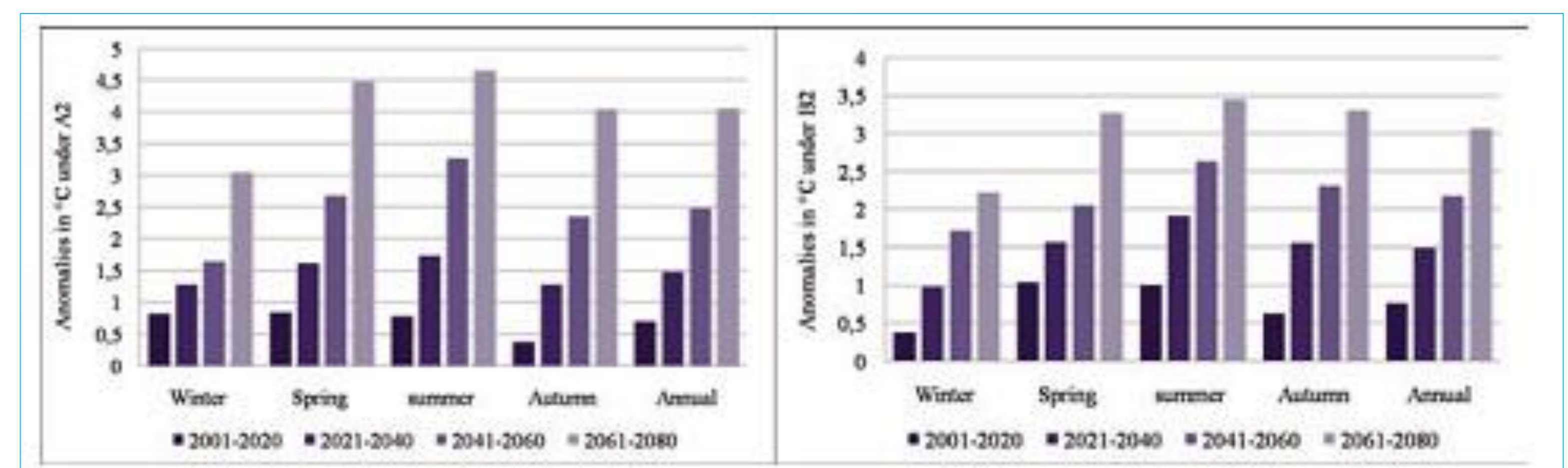


Figure 4. Seasonal and annual anomalies (°C) of mean temperature for the three future horizons 2020, 2050 and 2080 and for both A2 and B2 scenarios at MDV

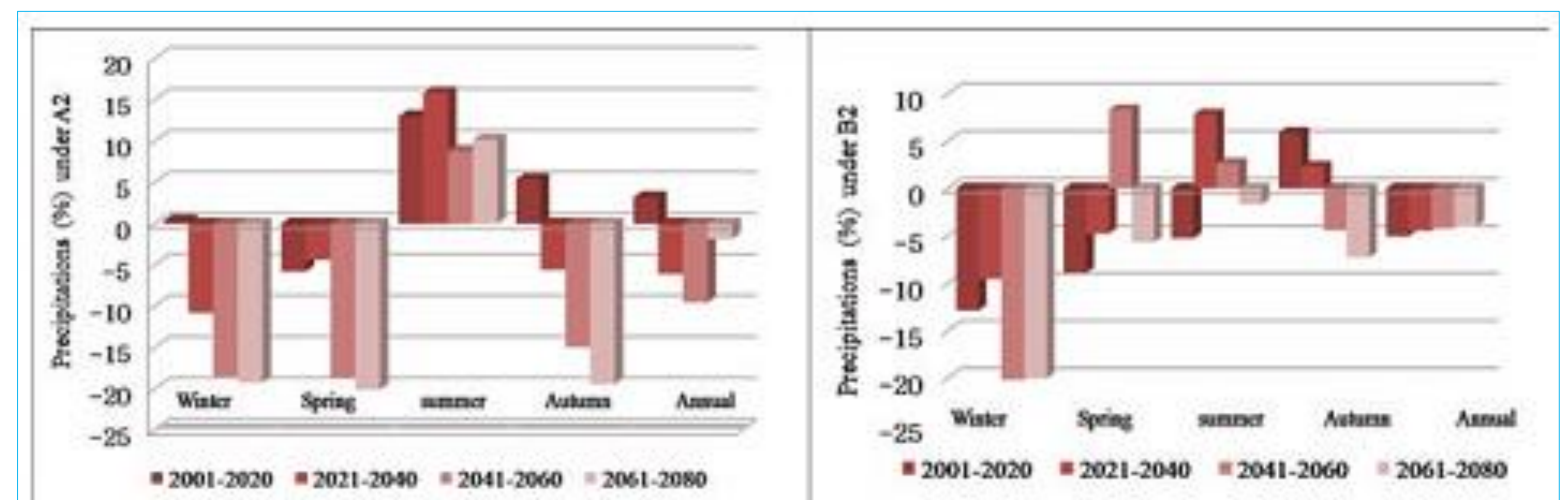


Figure 5. Percentage change in the level of cumulative seasonal (winter, spring and autumn) and annual for the three future horizons 2020, 2050 and 2080 and for both A2 and B2 scenarios at MDV

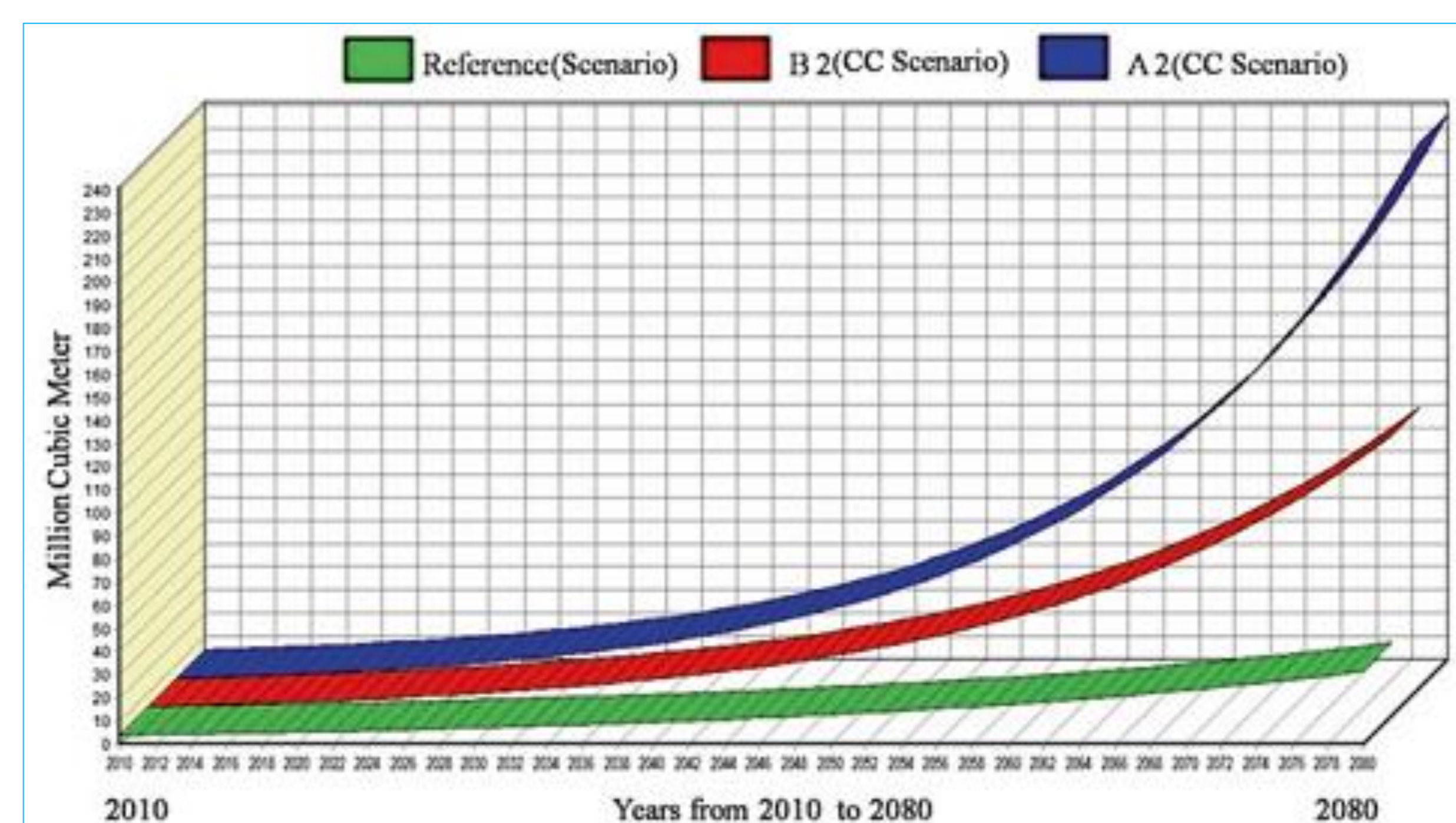


Figure 6. Water demand of all urban sites (the tree cities: Ouarzazate, Zagora and Agdez), under three scenarios (CC: Climate Change A2 and B2 and reference scenario) in Million Cubic Meter (MM3).

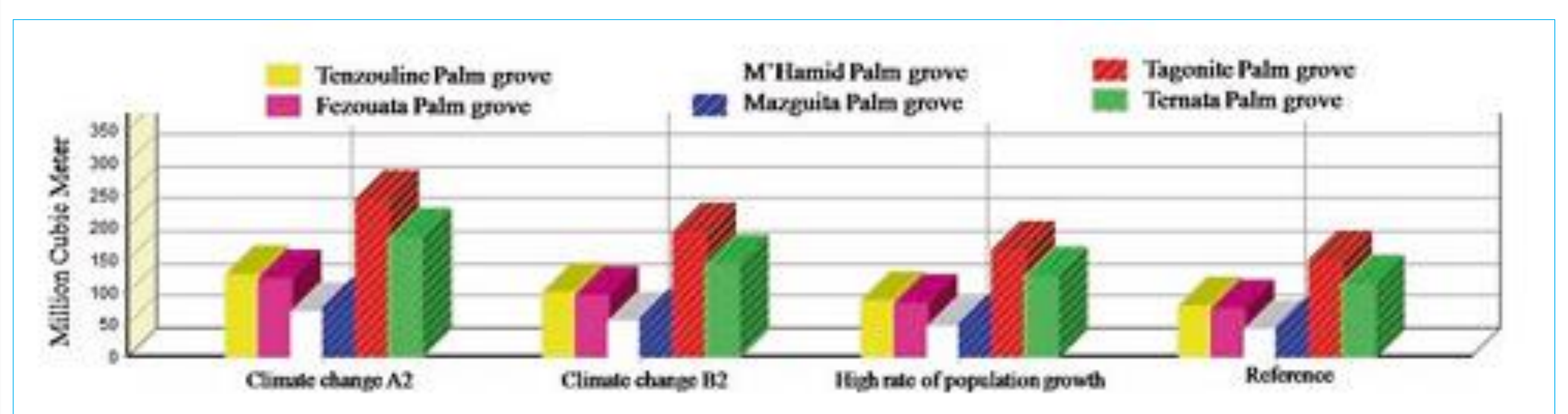


Figure 7. Water demand (not including loss and reuse) for the six palm groves under 4 scenarios (Climate change A2 and B2, High rate of population growth and the reference scenario) for the year 2020

Conclusion

The use of downscaled climate scenarios with water supply system model under climate change and socio-economic scenarios in the Middle Draa Valley showed an increasing prolonged drought from 2014 to 2080. The findings predict increases in average temperatures by about 1.4–3 °C in scenario A2 and by 1.6–2.7 °C in scenario B2 from 2011 to 2070. However the precipitations are supposed to decrease by 5.1–15% in A2 scenario and by 3.9–8.9% in B2 scenario. This trend of climate change may induce an increasing in water demand. The increase in crop water demands depicted that the area would not be able to meet their irrigation demands. CC will affect the storage levels in water surface and groundwater.

Acknowledgements

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- Karmaoui, A., Minucci, G., Messouli, M., Khebiza, M. Y., Ifaadassan, I., & Babqiqi, A. (2019). Climate Change impacts on water supply system of the middle draa valley in South Morocco. In *Climate change, food security and natural resource management* (pp. 163-178). Springer, Cham.
- Karmaoui, A., Ifaadassan, I., Babqiqi, A., Messouli, M., & Khebiza, M. Y. (2016). Analysis of the water supply-demand relationship in the Middle Draa Valley, Morocco, under climate change and socio-economic scenarios. *J. Sci. Res. Rep.*, 9(4), 1-10.

References

- Rochdane S, Reichert B, Messouli M, Babqiqi A, Yacoubi Khebiza M. Climate change impacts on water supply and demand in Rheraya Watershed (Morocco), with potential adaptation strategies. *Water*. 2012;4(1):28-44.